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(54) In-mould application of surface coatings to moulded articles

(57) To enable compressible surface coatings 20 to be applied to injection moulded articles during the moulding stage the coating is placed and retained in the mould space, to occupy a defined area of the surface of the mould space and molten plastics material is introduced into the mould space 13 at a relatively low pressure, gas injection being optionally used to pressurise the plastics. Various ways of retaining the coating in position in the mould are described.

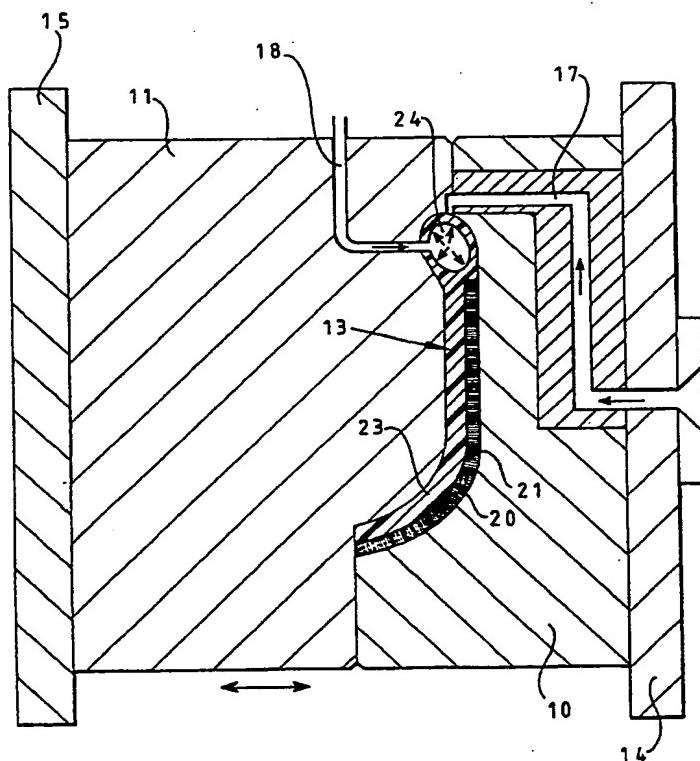


FIG 1

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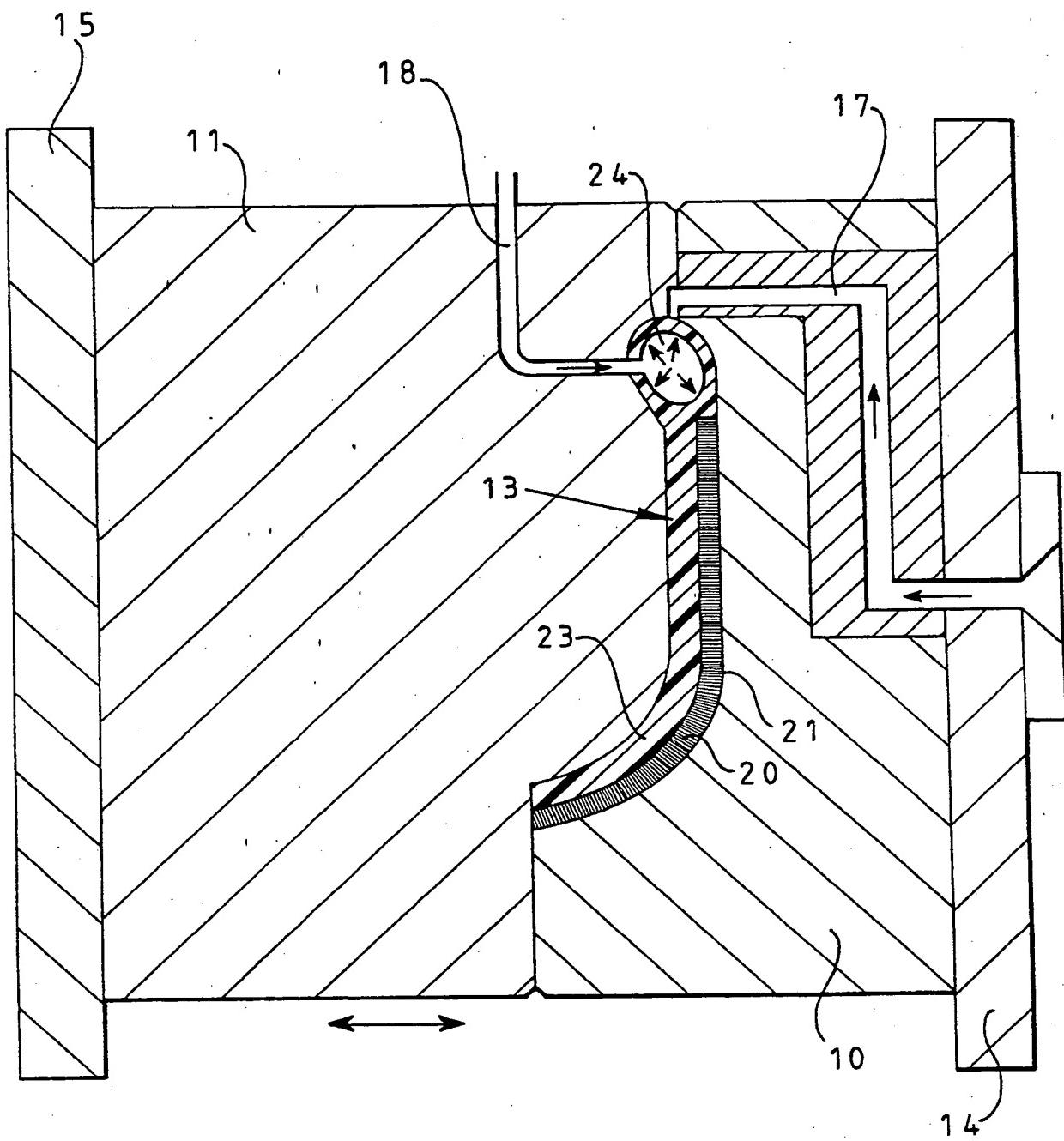
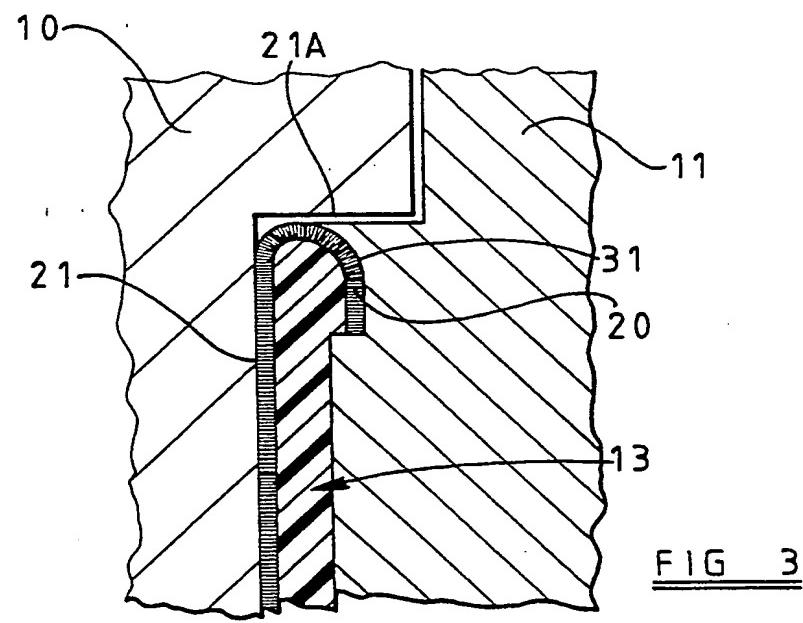
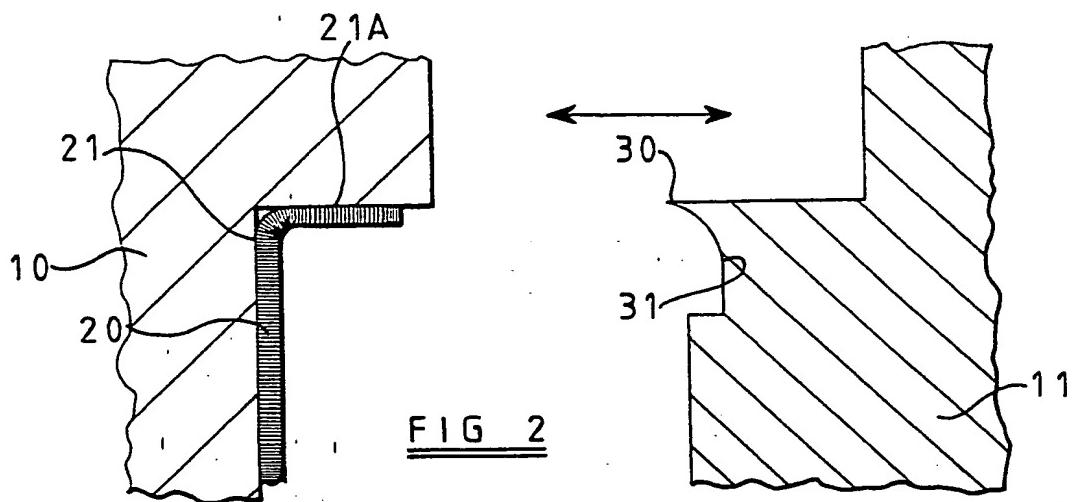
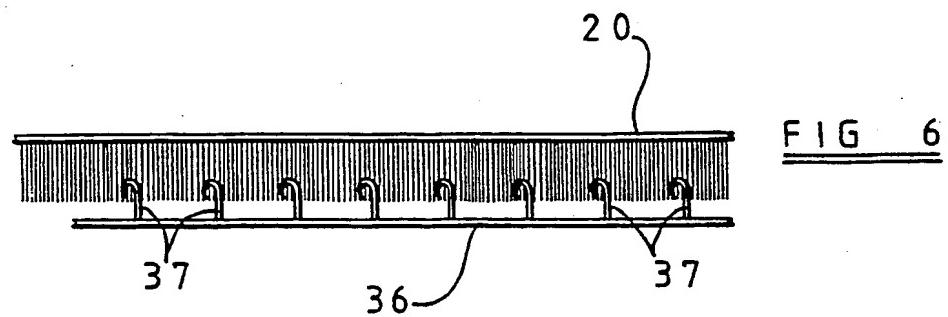
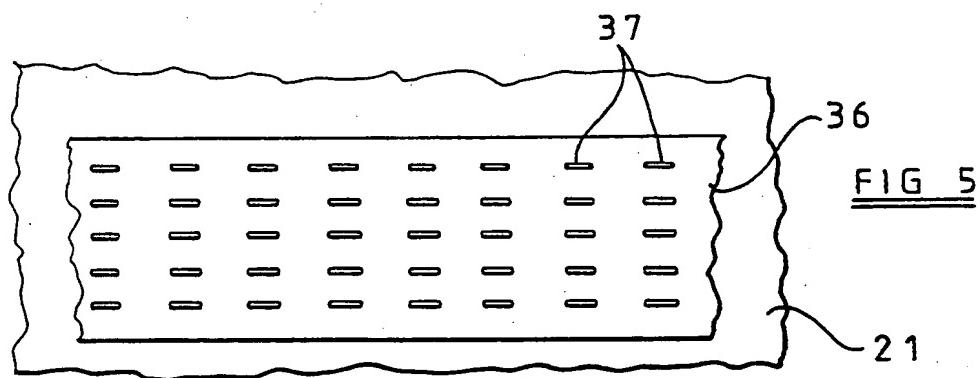
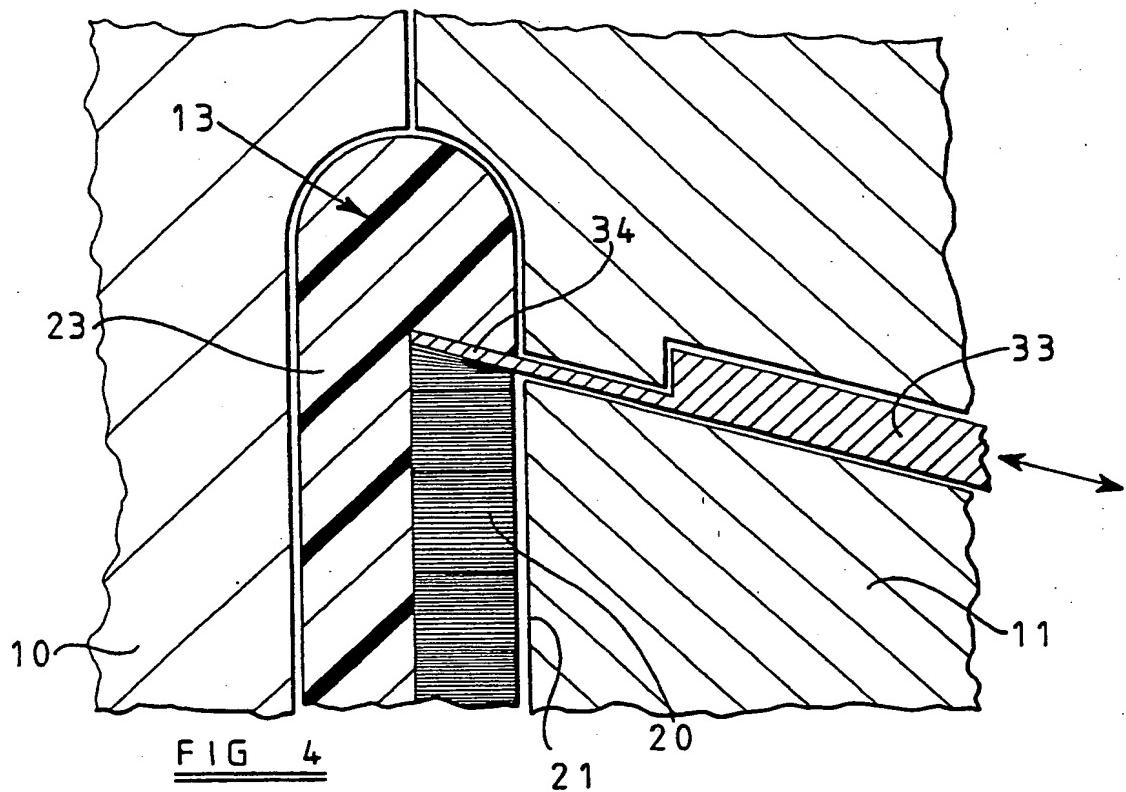


FIG 1

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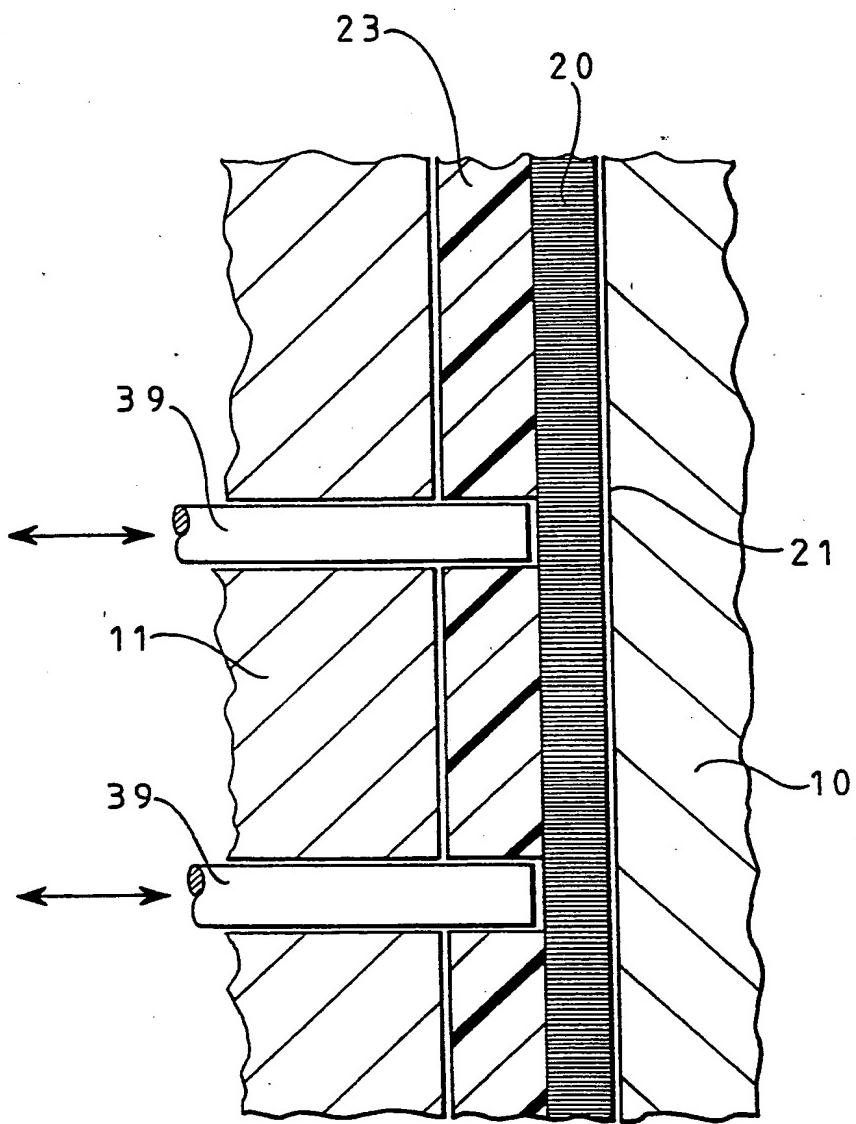


FIG 7

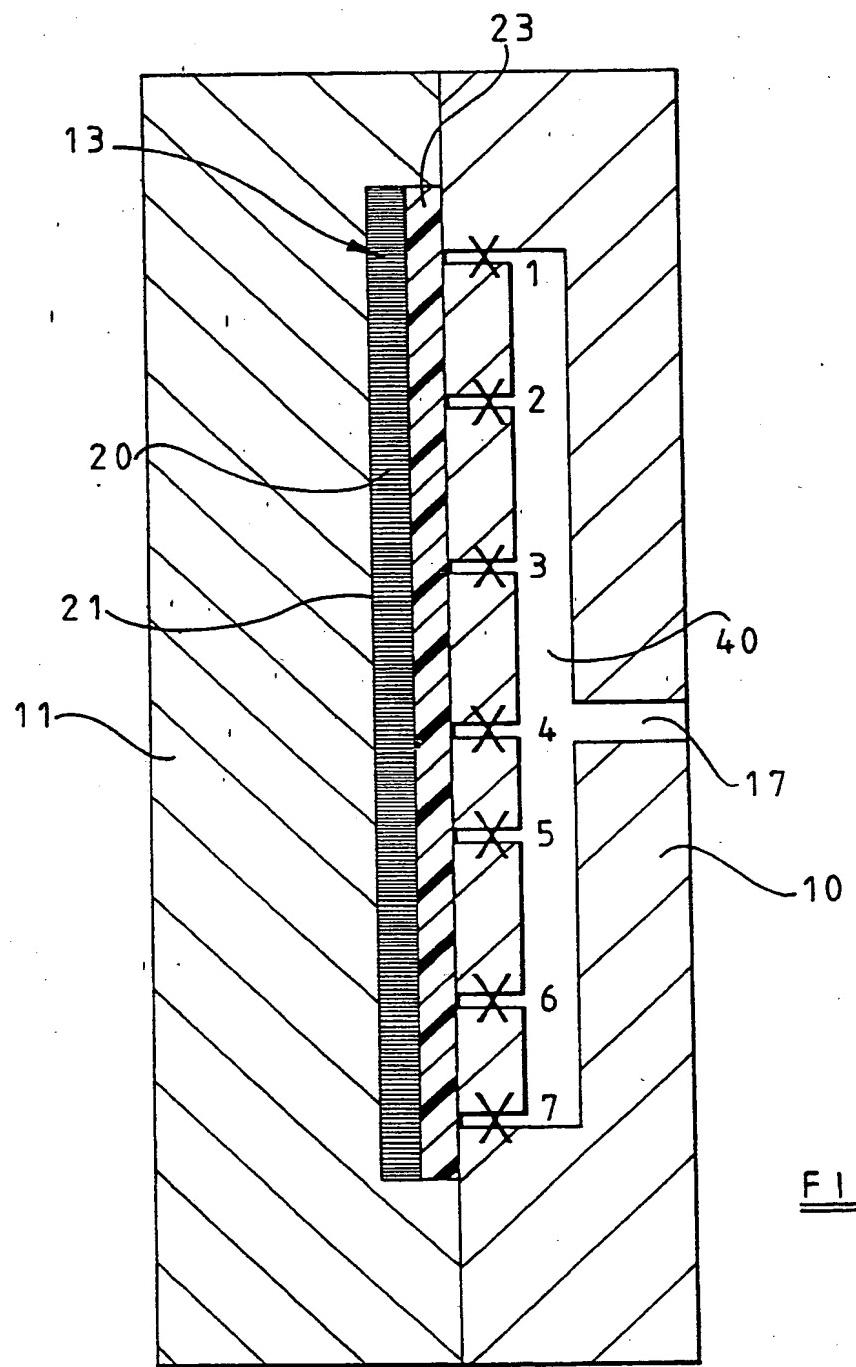


FIG 8

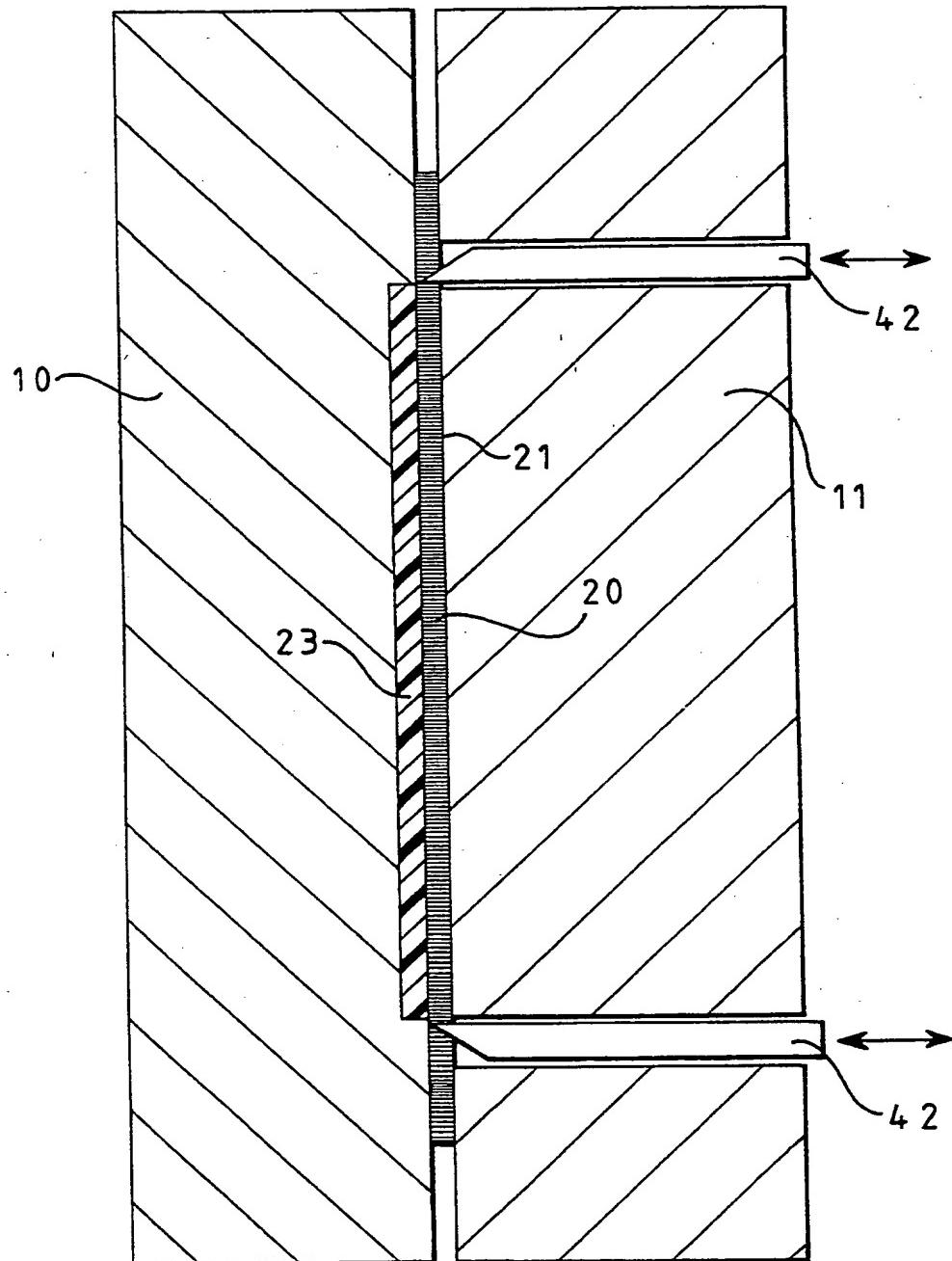


FIG 9

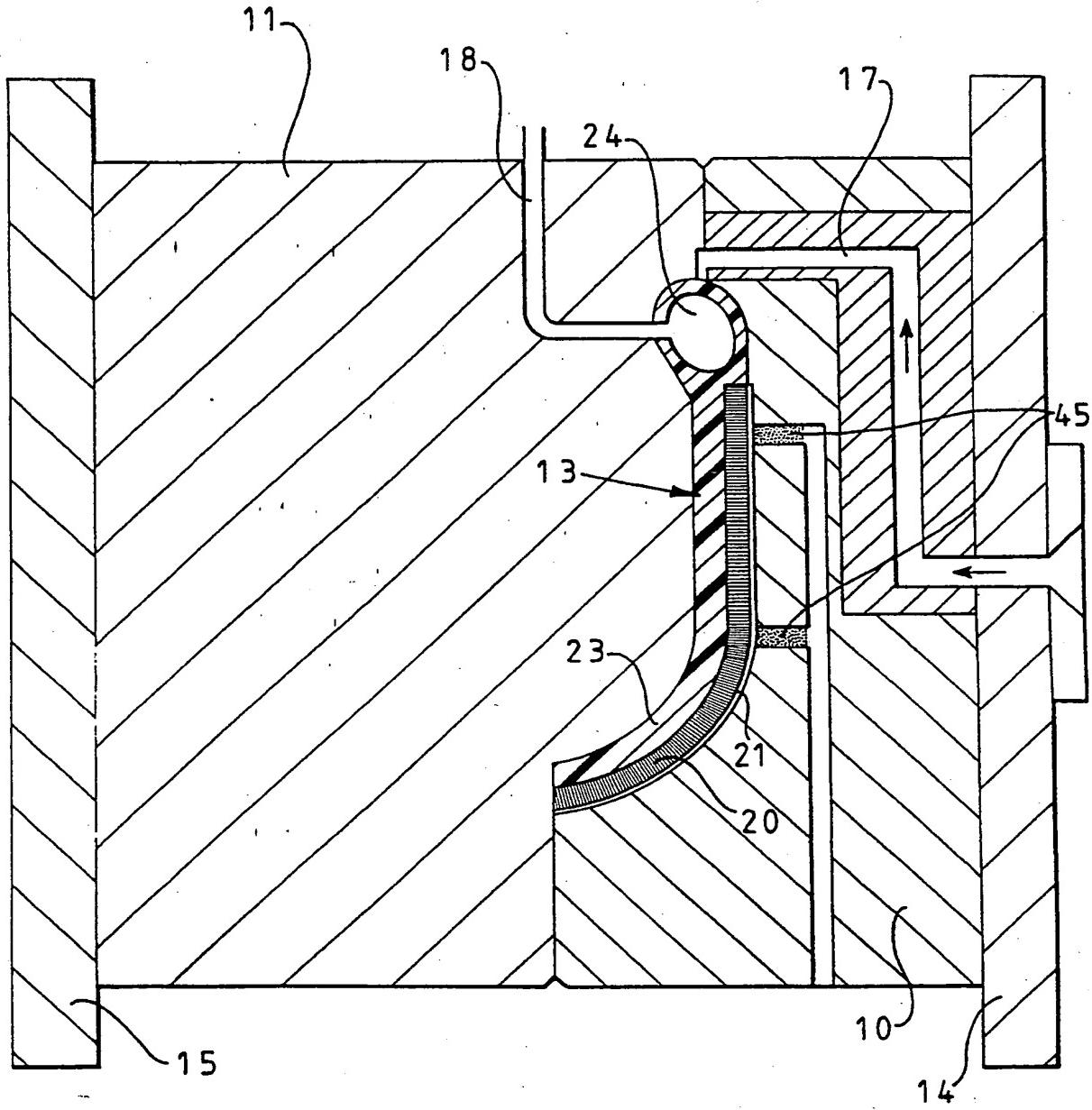


FIG. 10

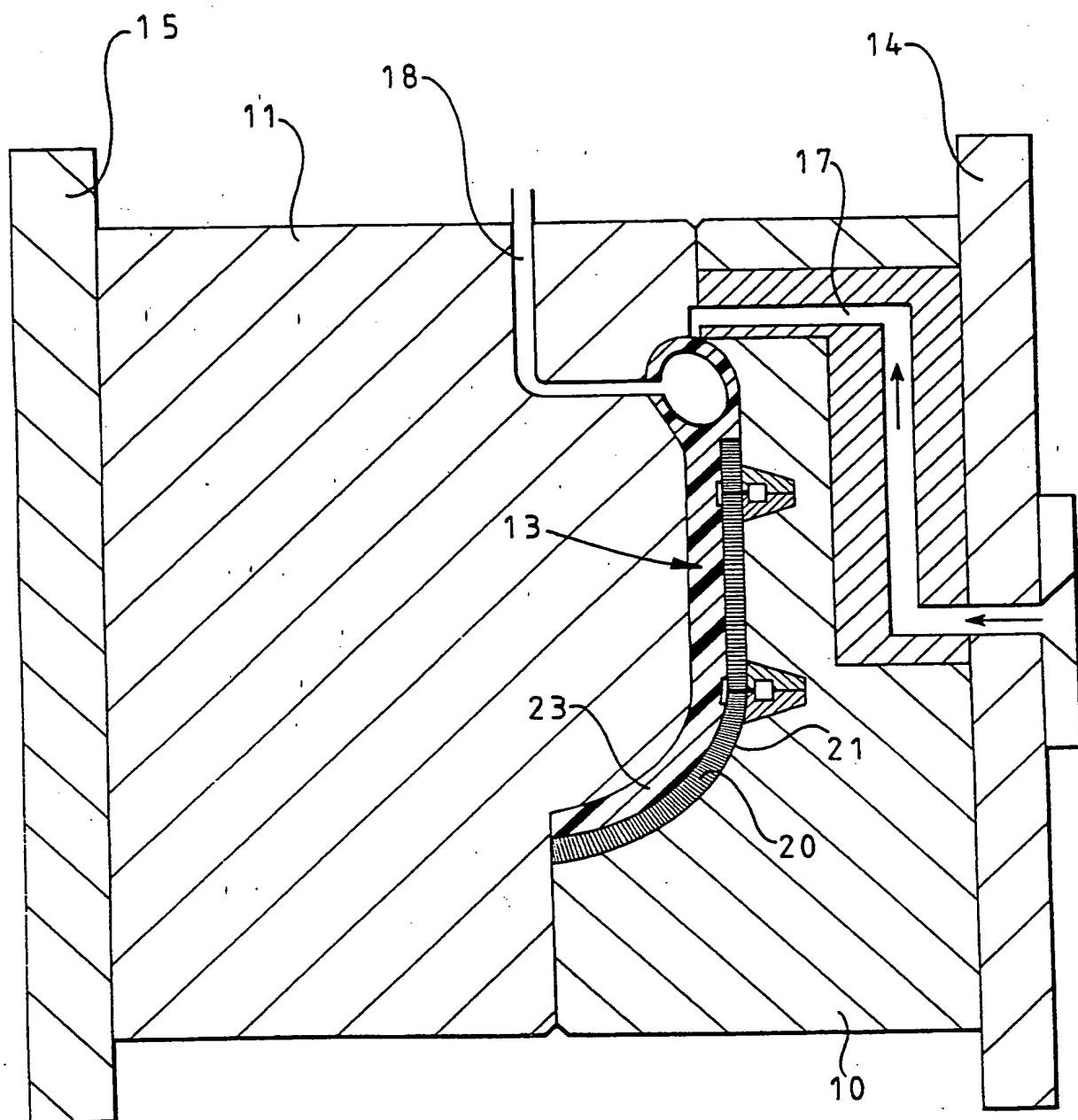


FIG 11

Applying Surface Coatings on Moulded Articles

The invention relates to a method and apparatus for applying surface coatings on moulded articles.

In producing plastics articles by injection moulding molten plastics is introduced into the mould under pressure to ensure that the plastics when set conforms to and reproduces the shape of the mould. Subsequent to release of the plastics article from the mould it is sometimes necessary to apply a surface coating to the article for example a paint finish. Other surface coatings may also be applied, for example, carpet or textile materials to a part of the surface of the article. In applying such materials it is necessary to ensure that the material is firmly adhered to the article, that the edge of the material presents a neat and defined edge or finish, that the material does not become compressed or otherwise distorted, and/or that the combining of the surface coating with the moulding is achieved in a cost effective manner.

An object of the invention is to provide an improved method and apparatus for applying surface coatings to moulded articles.

According to the invention a method of applying a surface coating to an injection moulded article comprises locating compressible surface coating material over at least part of a mould space of an injection moulding machine, retaining the material in position in the mould by retaining means at least during the introduction of molten plastics material into the mould space, putting the plastics material under pressure in the mould space at a pressure insufficient to materially permanently affect the characteristics of the coating material whereby, upon solidification of the plastics material the coating material is adhered to the plastics material for removal of the article from the mould with the coating

material adhered thereto.

Preferably the molten plastics material is put under pressure during at least part of the moulding operation by the introduction of pressurised fluid, conveniently nitrogen, into the molten plastics material within the mould space. By this means the pressure applied to the molten material may be reduced.

Preferably the coating material is carpet material having a compressible pile secured to a backing material, leather material, textile material or other soft and/or resilient material to be applied as a coating to the plastics article.

The coating material may be retained in the mould prior to and during the moulding process by a part of the mould engaging with the coating material such as by a movable part of the mould cooperating with the coating material carried on a fixed part of the mould when the parts are brought together. Alternatively the coating material may be secured to the mould prior to introduction of molten plastics material into the mould such as by releasable hooks locating with the coating material. As a further alternative the coating material may be secured in the mould by locating means such as reciprocal pins during the early part of the moulding operation, such locating means being removed from engagement with the coating material to complete the moulding process. As a still further alternative the coating material may be retained by introducing the molten plastics into selected parts of the mould space and onto the coating material at different stages during the moulding process.

The retaining means may comprise a plurality of tags which are each secured to the coating material and, during a moulding operation, the tags are releasably secured in relation to the mould surface against which the coating material is located, the tags being released from the mould surface on removal of

the article from the mould. The tags may each take the form of a flexible strand or length having enlarged portions at its ends.

Alternatively the coating material may be retained by adhering a sheet of flexible material over the coating material, applying the coating material into the mould space and holding the coating material in space by the application of a vacuum to the mould space surface adjacent the flexible sheet.

Conveniently the mould is provided with means for shaping the coating material to provide the desired finish at the edges of the coating material. Such means may be cutting means movably carried to cooperate with the mould during or at the conclusion of a moulding process to cut the coating material and define an edge of the material.

According to the invention apparatus for applying a coating material to injection moulded articles, comprises an injection moulding machine having a mould space in which the articles are to be formed, a receiving surface within the mould space in which a compressible surface coating material is locatable, retaining means for retaining the coating material on said receiving surface in a fixed position at least during introduction of molten plastics material into the mould space, inlet means for the molten material, pressurising means for putting the plastics material under pressure within said space at a pressure insufficient to materially permanently affect the characteristics of the coating material, and release means for releasing the moulded article with the coated material adhered thereto from the mould space.

Preferably the moulding machine includes means for introducing pressurised fluid, preferably nitrogen, into the mould space during the moulding process whereby the pressure imparted to the molten material during operation is, at least in part, the pressure of the pressurised fluid.

The mould space is generally defined between a fixed mould part and a movable mould part and the fixed mould part may define the receiving surface for the surface coating material.

In one arrangement the movable mould part cooperates with the fixed mould part and with the surface coating material when the fixed and movable mould parts are brought together.

In another arrangement a movable member is associated with the mould parts to locate the surface coating material at least during the initial stage of the moulding process.

For retaining the surface coating material in a selected region of the mould space the surface of the mould space may be provided with releasable gripping means for gripping the material during the moulding process.

As a further alternative a molten plastics may be arranged for introduction to the mould space at a plurality of positions, the points of introduction of the plastics material being changed during the moulding process to ensure retention of the surface coating material at the desired position.

The apparatus may include cutting means for cutting the surface coating material to define an edge thereof while coating material is located in the mould space.

It will be appreciated that with certain coating materials, such as carpet material, desirable characteristics of the material should not be materially altered during the moulding operation. Thus the plastics material should not pass through the coating material during the moulding process; the coating material should not be distorted, as for example by stretching; and the material should not be unduly compressed, preferably without having to provide the coating material with expensive protective means. It has been found that with the method and apparatus of the invention plastics injection

moulded articles can be coated with coating material in the mould, especially when using a low pressure injection moulding system.

Further features of the invention will appear from the following description of embodiments of the invention given by way of example only and with reference to the drawings, in which:-

Fig. 1 is a schematic cross section through part of an injection moulding machine,

Figs. 2 and 3 are cross sections of part of a mould arrangement for a moulding machine,

Fig. 4 is a cross section of part of another mould arrangement for a moulding machine,

Figs. 5 and 6 are a plan view and a cross section showing retaining means for coating material,

Fig. 7 is a cross section of part of a further mould arrangement for a moulding machine,

Fig. 8 is a cross section of part of a still further mould arrangement for a moulding machine,

Fig. 9 is a cross section of part of a further mould arrangement for a moulding machine,

Fig. 10 is a cross section of a still further mould arrangement, and

Fig. 11 is a cross section corresponding to Fig. 10 of an alternative arrangement.

Referring to the drawings and firstly to Fig. 1 an injection

moulding machine is generally of conventional form having mould parts 10 and 11 defining a mould space 13. The mould part 10 is mounted on a fixed platen 14 and the mould part 11 is mounted on a movable plate 15 and is usually moved by a hydraulic ram (not shown) towards and away from the fixed mould part 10.

Molten thermoplastics material is introduced into the mould space 13 through a conduit 17 in the fixed mould part 12 and in the platen 14. In the illustrated arrangement there is additionally provided a duct 18 in the movable mould part 11 through which pressurised fluid, preferably nitrogen gas, is introduced into the mould space 13.

The mould space 13 is shaped according to the moulded article to be produced, in this case a moulded part of a motor vehicle on which a coating material, such as carpet material, is to be adhered.

Prior to commencement of a moulding operation a coating or covering material 20 of the requisite size and shape is located against a surface 21 of the mould space 13 with the movable platen 15 and mould part 11 in the retracted or withdrawn position. The material 20 is retained in position in the space 13 by one of several means to be described or by seating the material against a defined portion of the mould space surface 21 such as a shoulder, depression or edge. Such retaining means needs to retain the material in position during moulding without the material moving or becoming distorted by undesired stretching or deformation when the molten plastics is introduced.

After locating the material 20 in the mould space the movable mould part 11 is moved to the moulding position engaged against the fixed mould part 10, as shown. Molten thermoplastics material 23 is then introduced to the mould space 13 under pressure along the duct 17 in known manner.

As the thermoplastics material flows into the mould space 13 pressurised gas is introduced into the plastics material in the mould space along the duct 18, the end of which protrudes into the mould space 13 and the gas forms a gas channel 24 in the plastics material which in the completed article becomes a void.

The introduction of said gas pressurises the plastics material to ensure that the material is urged into contact with the sides of the mould to take up the shape of the mould surfaces. By the use of such gas pressurisation lower pressures are present in the mould compared with conventional injection moulds whilst still achieving adequate moulding performance.

Pressures in the mould may be of the order of 300 bar which may be only one third of the pressure of conventional injection moulding pressures.

Thus with carpet, leather and other relatively soft materials which may also be pervious to the molten plastics material the material is not unduly compressed or distorted or subject to the molten material migrating through the material during the moulding process.

Upon setting or solidification of the plastics material 23 the coating material 20 becomes adhered to the plastics material.

The movable mould part 11 is moved to the withdrawn position and the moulded article complete with the covering 20 adhered thereto is removed.

Other injection moulding methods can also be used such as gas melt injection moulding, 2K moulding and other low pressure moulding methods.

Referring to Figs. 2 and 3 of the drawings in which a detail of the mould is shown, the coating material 20 is located on the receiving surface 21 of the fixed mould part 10, the receiving surface 21 having a right-angle portion. The

movable mould part 11 is formed with an edge portion 30 which cooperates with part of the receiving surface 21, designated 21A, and adjacent the edge 30 is a recess 31.

When the movable mould part 11 approaches the fixed mould part 10 the edge 30 locates between the covering 20 and the surface 21A and the edge of the covering 20 is turned over and is received in the recess 31 to take up the position shown in Fig. 3. Upon closing up of the mould parts 10 and 11 the molten thermo plastics material is injected into the mould space 13, as previously described. Upon setting of the thermo plastics material it is adhered to the coating material 20 so that upon withdrawal of the movable mould part 11 the coating material takes up a curved profile along its edge and is firmly adhered to the plastics. By this means a clearly defined edge of the coating material is achieved which presents a neat and attractive appearance.

Referring now to Fig. 4 an alternative means for locating the covering material 20 is illustrated. In this arrangement the movable mould part 11 carries a blade 33 reciprocally movable relative to the mould part 11 by hydraulic or other means. At its extended position the blade 33 has a portion 34 which enters the mould space 13 to locate an edge of the material 20 so that the material 20 is retained against the surface 21 in the desired position.

The blade 33 remains in its extended position during the introduction of the molten thermo plastics material 23 into the mould space 13. The blade 33 is withdrawn from the extended position to a position in which the portion 34 is in alignment with the surface 21 during the later stages of injection of the plastics material. This arrangement ensures that the coating material 20 has a clearly defined edge flush with the surface of the solidified plastics material.

Referring now to Figs. 5 and 6 there is shown another means

for retaining the coating material 20 in the mould part during introduction of the molten thermo plastics material into the mould space. In this case the surface 21 of the mould space has fixed to it material 36 carrying a plurality of hooks 37 which are intended to locate the coating material 20 in the manner of Velcro (trade mark) material. By such an arrangement the coating material is retained in position in the mould but, upon completion of the moulded article adhered to the coating material 20, the article may be removable from the mould by peeling off from the hooks 37.

Referring now to Fig. 7 of the drawings an alternative retaining arrangement is shown. In this arrangement the coating material 20 is located against a surface 21 of the mould space 13 on the fixed mould part 10. It is retained in position prior to a moulding operation by reciprocal pins 39 which at the commencement of the introduction of the molten thermo plastics material 23 into the mould space 13 are in the extended position as shown in Fig. 7. The pins 39 are then retracted so that their ends lie flush with the side of the mould space and further thermo plastics material is injected to fill the spaces left by the pins 39.

Referring now to Fig. 8 an alternative method of locating covering material 20 in the mould space 13 is shown. The fixed mould part 10 with the conduits 17 for introduction of thermo plastics material leads into a manifold 40 from which lead a plurality of inlet nozzles 1-7. Each of the inlet nozzles is controlled by a shut off valve and the shut off valves are controlled to introduce the molten thermo plastics material along selected nozzles during the course of the moulding operation. Thus thermo plastics material 23 may be introduced through nozzle 1 initially, the shut off valve associated with nozzle 1 is closed and that associated with nozzle 2 is opened so that the nozzles are successively opened and closed. If desired two nozzles, say 1 and 7, can be opened and closed together. In this way the material 20 is

retained in the mould space 13 in the required position.

Referring now to Fig. 9 another arrangement for retaining and trimming the coating material 20 is shown. The length of coating material 20 is laid against a surface 21 in the movable mould part and overlaps the mould space 13, the overlapping portion being located between the mould parts 10 and 11. Cutters 42 are reciprocally movable relative to the mould part 11 and during the moulding operation are extended towards the mould part 10 to trim the overlapping edges of the coating material 20 so that the edges lie flush with the ends of the plastics material 23.

Referring now to Fig. 10 a further method and apparatus for holding the covering material 20 in position in the mould space 13 is shown. In this case a sheet of flexible plastics material, such as polythene sheet is first applied to the surface of the covering material and adhered thereto, in the case of carpet, to the pile of the carpet. The adhesive is of the kind which will subsequently allow the sheet to be removed without adversely affecting the surface of the material 20.

The covering material 20, with the flexible sheet applied thereto, is placed against the surface 21 of the mould space 13 and the surface 21 is provided with a plurality of openings 45 each communicating with a source of vacuum. When vacuum is set up in the openings 45 the material 20 is drawn on to the surface 21 and retained thereon due to the use of the flexible impervious sheet.

The flexible sheet is removed from the mould with the completed article and the sheet may be released from the article at any convenient time which may be after the article has been fitted to, for example, a vehicle. Thus the flexible sheet can also act as a protective cover over the coating material 20 after the article is formed.

Referring now to Fig. 11 another arrangement for holding the covering material 20 in position during a moulding operation is shown. In this arrangement a plurality of tags 46 are attached through the covering material to be secured thereto.

Each of the tags 46 is formed as a strand or length of flexible plastics and at the ends of each length are formed enlarged portions, for example, more rigid portions extending transverse to the length in the form of a rod or tab, of the kind used for labelling garments. The tags 46 are affixed to the backing of the carpet or other coating material by inserting one end through the weave so that the other end projects outwardly of the material 20.

In the surface 21 of the mould space 13 against which the material 20 is to be located there are arranged clamping means 47 in which the free ends of the tags 46 may be clamped when the material 20 is in the desired position.

During a moulding operation the material is held in place with the tags 46 clamped and upon completion of the moulding operation the clamping means 47 are released to allow the article with its covering 20 to be removed. After removal the protruding parts of the tags are cut off flush with the surface of the covering material.

The clamping means 47 may be hydraulically operated to open end close jaws which engage the tags.

It will be appreciated that various other arrangements can be employed for retaining and trimming the coating material to be adhered to the plastics article.

The invention, in fixing coating material to injection moulded articles during the moulding operation, provides a quick and simple system for providing the desired finish to the moulded article. It avoids a separate stage in applying the coating to the article and ensures that the coating material becomes

an integral part of the article while providing a neat and attractive assembly, without the need for trimming the edges of the coating material.

Claims

1. A method of applying a surface coating to an injection moulded article comprising locating compressible surface coating material over at least part of a mould space of an injection moulding machine, retaining the material in position in the mould by retaining means at least during the introduction of molten plastics material into the mould space, putting the plastics material under pressure in the mould space at a pressure insufficient to materially permanently affect the characteristics of the coating material whereby, upon solidification of the plastics material the coating material is adhered to the plastics material for removal of the article from the mould with the coating material adhered thereto.
2. A method according to claim 1 wherein the molten plastics material is put under pressure during at least part of the moulding operation by the introduction of pressurised fluid such as inert gas into the molten plastics material within the mould space.
3. A method according to claim 1 or 2 wherein the coating material is carpet material having a compressible pile secured to a backing material.
4. A method according to any one of the preceding claims wherein the coating material is retained in the mould by securing retaining elements in the mould, securing the retaining elements to the coating material during a moulding operation, the retaining elements being released from the mould and/or the coating material when the article is released from the mould.
5. A method according to claim 4 wherein the retaining elements comprise a plurality of hook elements secured to the surface of the mould space to which the coating material is to be applied, the hook elements being securable to the surface

of the coating material which lies adjacent the mould surface during a moulding operation.

6. A method according to claim 4 wherein the retaining elements comprise a plurality of tags which are each secured to the coating material and, during the moulding operation, the tags are releasably secured in relation to the mould surface against which the coating material is located, the tags being released from the mould surface on removal of the article from the mould.

7. A method according to claim 6 wherein the tags each comprise a strand or length of flexible material having enlarged portions at the ends of the strand for securing the tags in relation to the coating material, the length of flexible material being passed through the coating material and the enlarged portion at one end of the length preventing removal therefrom, the enlarged portion at the opposite end of the length being securable in relation to said mould surface.

8. A method according to any one of claims 1-3 wherein the coating material is secured in the mould by applying flexible sheet material over a surface of the coating material and releasably securing the sheet material thereto, placing the coating material in the mould space with the sheet material against a surface of the mould space, applying a vacuum to the said surface of the mould space to retain the coating material in position during moulding, and releasing the article from the mould together with the sheet material.

9. A method according to any one of claims 1-3 wherein the coating material is retained in the mould space against a mould surface during an initial period of the moulding operation by movable retaining pins which urge the coating material towards said mould surface at least during said initial period, the pins being withdrawn from the coating material before solidification of the plastics moulding

material.

10. A method according to any one of claims 1-3 wherein the coating material is located against a surface of the mould space and molten plastics material is introduced into the mould space in a controlled manner from a plurality of positions whereby to retain the coating material in the desired position on said surface.

11. A method according to claim 10 wherein said plurality of positions each include an inlet controlled by an inlet valve whereby the timing and duration of the flow of plastics material through the inlets into the mould space is controlled to ensure retention of the coating material in position in the mould space.

12. A method according to any one of the preceding claims wherein the coating material occupies a discrete area of the surface of the mould space and the edges of the coating material are defined and require no further trimming after the moulded article is removed from the mould, the mould having means for defining the edges of the coating material.

13. A method according to any one of the preceding claims wherein blade means is arranged to define the edges of the coating material, the blade means being located at the edge of the coating material and arranged to reciprocate relative to the coating material to engage the material to cut, locate and/or fold the material at said edge when located in the mould space.

14. A method according to claim 13 wherein the blade means is associated with one of the parts of the mould which parts, when brought together, define the mould space between them, and the blade means moves reciprocally relative to the associated mould part to cut, locate and/or fold the edges of the coating material.

15. A method according to claim 13 wherein the blade means forms a portion of the mould defining the mould space and, as the parts of the mould are brought together, after location of the coating material in the mould space, the blade means cuts, locates and/or folds the edges of the coating material.

16. Apparatus for applying a coating material to injection moulded articles, comprising an injection moulding machine having a mould space in which the articles are to be formed, a receiving surface within the mould space in which a compressible surface coating material is locatable, retaining means for retaining the coating material on said receiving surface in a fixed position at least during introduction of molten plastics material into the mould space, inlet means for the molten material, pressurising means for putting the plastics material under pressure within said space at a pressure insufficient to materially permanently affect the characteristics of the coating material, and release means for releasing the moulded article with the coated material adhered thereto from the mould space.

17. Apparatus according to claim 16 wherein the mould space is defined between a fixed mould part and a movable part, the fixed mould part defining the receiving surface for the coating material and the fixed mould part being associated with the retaining means for the coating material, retaining means including securing means for holding the coating material, the securing means being releasably securable to the fixed mould part.

18. Apparatus according to claim 16 or 17 comprising retaining elements for retaining the coating material in the mould during a moulding process, the retaining elements each being securable to the coating material and to the adjacent mould part and the retaining elements being releasable either from the coating material or the mould part after a moulding operation.

19. Apparatus according to claim 16 or 17 comprising a flexible sheet material which is securable over a surface of the coating material, and vacuum forming means arranged to apply a vacuum to a surface of the mould space to which the coating material is to be applied, whereby after location of the coating material in the mould space it is held in position by application of the vacuum to the sheet material.

20. A method according to any one of the claims 16-19 comprising blade means arranged to define the edges of the coating material, the blade means being arranged at the edge of the coating material and being reciprocal relative to the coating material to engage the material during a moulding operation to cut, locate and/or fold the edges of the material during a moulding operation.

Patents Act 1977
 Examiner's report to the Comptroller under Section 17
 (The Search report)

Application number
 GB 9313882.4

Relevant Technical Fields		Search Examiner J P LEIGHTON
(i) UK Cl (Ed.L) B5A (AB2;AB19;AD20;AD28;AT14P)		Date of completion of Search 14 OCTOBER 1993
(ii) Int Cl (Ed.5) B29C (45/14)		Documents considered relevant following a search in respect of Claims :- 1-20
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications.		(ii)

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Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2103534 A	(OMRON TATEISI ELECTRONICS) whole disclosure	1 and 9 at least
X	GB 1520044	(ANTONIO NOVA) whole disclosure	1 and 9 at least
X	GB 1160975	(ICI) whole disclosure	1 and 10 at least
X	EP 0283207 A2	(CINPRES LTD) see especially page 1 lines 3-22	Claim 1 at least
“	EP 0281724 A1	(TECNOS SPA) see column 5 lines 27 et seq	1, 3 and 8 at least
X	EP 0094268 A1	(SO-GE-MA-P SOC ANONYM) see page 5 paragraph 1	1 at least

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